GRUMMAN

Grumman Corporation

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: MANIPULATOR FOOT RESTRAINT

ASSEMBLY PART NO. SED 33 [illegible]

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO. RMS 87 [illegible]
REVISION [illegible]
DATE [illegible] MARCH [illegible]

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
H3		Payload Interface Mechanism (PIM) QTY (1) Dwg C95-105	1R/2	H3 - Inadvertent release of PIM latch due to structural failure of latch, latch spring or lock mechanism resulting from defective material	**END ITEM** PIM inadvertently releases payload **GFE INTERFACE** Payload is not secured to MFR **MISSION** Possile loss of mission due to damaged payload. **CREW/VEHICLE** Payload is not restrained; possible impact with crewman/vehicle	**A. Design** Redundancy- Latch and latch lock must fail prior to release of payload. "B" screen is not applicable, latch is a mechanical linkage. In addition to considering the launch loads discussed under cases A1 and B1, the MFR has been designed to accomodate the following conditions in the deployed configurations: - Astronaut handling loads of one hundred pounds in any direction. Inertial response loads of MFR to RMS runaway accelerations (2.6 ft/sec/sec linear accel x, y, or z axes and 0.5 rad/sec/sec Roll accl about x axes) - RMS constrained motion load of 300 pounds ultimate, any point, any direction. - 140 pound couple by each foot to footplate assembly - 340 pound load applied to any tether/reel assembly. - The design minimizes orbital EVA thermal stresses by utilizing aluminum as the one basic structural material, coated with a low absorption thermal control coating per Grumman spec CSS-MFR-PS-001 Using the above load spectrum design safety margins of 1.14 for deformation and 1.40 for failure have been achieved. All springs are corrosion resistant and will be cycled a small fraction of nominal cyclic life in the 20 mission life of the MFR. Fatigue life based upon random response loads with appropriate stress concentration factors has been established using a scatter factor of 4.0(e.g., 80 mission fatigue life based upon S-N curves). All materials are per table 1 and 2 of MSFC SPEC-522A, to reduce stress corrosion and are certified for traceability/quality.

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ASSEMBLY PART NO: SED 33100100

PREPARED BY: L. HAHN & F. PERAZZO

REPORT NO: PM3 87 R 1
REVISION C
DATE 3 MARCH 1988

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT	FAILURE MODE AND CAUSE	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
H3		Payload Interface Mechanism (PIM) QTY (1) Dwg C95-105	1R/2	H3 - Inadvertent release of PIM latch due to structural failure of latch, latch spring or lock mechanism resulting from defective material	**END ITEM** PIM inadvertently releases payload **GFE INTERFACE** Payload is not secured to MFR **MISSION** Possile loss of mission due to damaged payload. **CREW / VEHICLE** Payload is not restrained, possible impact with crewman/vehicle	**B. TEST HISTORY** 1. Acceptance test per procedure 380 94 01 at Grumman (7/7/83) before and after all tests. ATP includes functional tests of all operating functions and a general visual inspection. 2. Stiffness test per procedure 380-901 01 at Grumman (7/7/83). Demonstrated stanchion end play less than .5 inch for a five pound load in any direction and deflection less than 3 inches lateral and 2 inches longitudinal for 1 hundred pound loads. 3. Vibration and shock test per procedure 380 98 01 at Grumman (7/7/83). Demonstrated ability to withstand design levels without structural failure with no significant resonance. Several screws required the application of loctite. 4. APC/MFR ultimate load tests per STS83 0914 at Rockwell (2/83). Loads applied in 14 steps, each comprising 10% of limit load no yield was observed at the ultimate load of 1.4 x limit. 5. Thermal vacuum test at JSC (7/29/84). MFR was operated at ambient temperature, plus 221 F and -137 F (average lowest achievable chamber temp) at an average vacuum of .00006 torr. 6. Center of gravity test at JSC (12/21/84). 7. Moment of inertia swing test at JSC (1/4/85). **C. INSPECTION** 1. NAVPRO inspects all production end items at completion of final assembly. 2. Anodic hard coated aluminum parts inspected for compliance to MIL-A-8625 C by DCAS. Certificate of compliance on file at Grumman Bethpage. 3. Thermal Control Coating process is controlled by inspections (post prime, cure, post coating and cure), and sample testing for coating thickness, coating adhesion, and emittance/solar absorption. **D. FAILURE HISTORY** None (per PRACA database). The MFR has been successfully utilized on five missions, STS 11, 13, 51A, 51I, and 61C. **E. TURNAROUND** Inspection per S28/PIA 05001 N/C 30 DEC 1987 includes a functional test of all MFR operating functions and a general visual inspection. **F. OPERATIONAL USE** 1. Operational Effect of Failure - Unlikely, due to mass and low rates of payload, that impact would cause any major damage. 2. Crew Action - EVA crewman would stabilize loose payload or the orbiter would be required to move away. 3. Crew Training - Crew would be trained to do above. 4. Mission Constraints - none. 5. In Flight Checkout - Operation of PIM will be checked out at time of use.